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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/823,840	LUBOMIRSKY ET AL.	
	Examiner	Art Unit	
	Zulmariam Mendez	1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04/13/2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *08/02/2004 and 07/12/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 3,14, 22 and 23 are objected to because of the following informalities: the units for current density are: ampere per square length (A/cm^2) instead of ampere per cubic length (A/cm^3). See Perry's Chemical Engineers' Handbook, 7^{th} edition, table 1-2b.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 2, 4, 8, 9, 11-13, 16-18, and 25-28 are rejected under 35 U.S.C. 102(e) as being anticipated by Hey et al. (US Patent Publication no. 2003/0034250).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome

either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

With regard to claim 1, Hey discloses a reverse bias for electrochemical plating system and method comprising: removing the substrate from a plating solution contained in the plating cell after the electroplating process is completed; applying a plating bias to a plating surface of the substrate during the removing step (page 14, paragraph [0121]); and controlling the plating bias to maintain a constant current density across an immersed portion pf the plating surface during the removing step (page 15, paragraphs [0123] and [0124]).

With regard to claim 2, the controlling system of Hey comprises using at least one of a current control and a voltage control system to maintain the constant current density (page 15, paragraph [0124]).

With regard to claim 4, the substrate removal, as disclosed by Hey, further comprises rotating the substrate during the removal step (page 14, paragraph [0121]).

With regard to claim 8, Hey discloses a method for removing a substrate from a plating solution, comprising: moving the substrate out of the plating solution; rotating the substrate during the moving; applying a forward bias to the substrate during the moving (page 14, paragraph [0121]); and tilting the substrate to a tilt angle during the removing (page 16, paragraph [0129]).

With regard to claim 9, tilting the substrate, as taught by Hey, comprises maintaining a constant tilt angle from the horizontal during the moving (page 16, paragraph [0129] and page 17, paragraph [0147]).

With regard to claims 11 and 12, the method disclosed by Hey further comprises controlling the application of the forward bias to maintain a constant current density across an immersed portion of the substrate during the moving by using a current controller (page 15, paragraphs [0123] and [0124]).

With regard to claim 13, controlling the forward bias of Hey comprises using a time dependent controller (page 3, paragraph [0045]).

With regard to claim 16, the forward bias applied in the method as taught by Hey, is configured to generate a plating rate sufficient to overcome etching of a layer deposited on the substrate (page 16, paragraphs [0130-0131]).

With regard to claim 17, Hey discloses a method for removing a substrate from a processing fluid contained in a processing cell, comprising: tilting the substrate to a tilt angle (page 16, paragraph [0129]); rotating the substrate; moving the substrate upward out of the processing fluid (page 14, paragraph [0121]); and applying an electrical removal bias configured to generate a constant current density across a substrate surface during the moving of the substrate out of the processing fluid (page 15, paragraph [0126]).

With regard to claim 18, the method as disclosed by Hey comprises tilting, rotating, and raising the substrate holder assembly simultaneously (page 14, paragraph [0121]).

With regard to claim 25, the method of Hey further comprises applying a removal bias maintaining a constant current density across an immersed surface area of the substrate during the upward movement of the substrate out of the processing fluid (page 15, paragraph [0123]).

With regard to claim 26, Hey discloses a method for removing a semiconductor substrate from an electrochemical plating solution, comprising: tilting the substrate to an angle with respect to horizontal (page 16, paragraph [0129]); rotating the substrate at a rotation rate of between about 50 rpm and about 3000 rpm; vertically moving the substrate out of the plating solution; and applying a forward bias (a slight negative or neutral voltage) to an immersed surface of the substrate during the vertically moving (page 14, paragraph [0121]).

With regard to claim 27, the forward bias applied in the method of Hey is adjusted during the vertical moving to generate a constant current density across an immersed surface area of the substrate. (page 15, paragraph [0123]).

With regard to claim 28, Hey discloses rotating, moving, and applying a forward bias simultaneously to the substrate holder assembly after the electroplating process is completed (page 14, paragraph [0121]). The process also comprises tilting the substrate holder during immersion such that the plating surface is positioned at an angle with respect to horizontal. Such tilting provides for removal of air or air bubbles that may otherwise be trapped within the electrolyte solution underneath portions of the substrate holder assembly and/or substrate, during the immersion process (page 16, paragraph [0129]). Knowing that it is possible to remove air bubbles underneath the substrate by

tilting the substrate holder when placing it into the plating solution, it is obvious to use the same technique to prevent bubbles formation when the substrate is being removed from the solution. Therefore, tilting, rotating, moving and applying an electric bias can be conducted simultaneously after the electroplating process is completed.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 5, 6, 7, 15, 20, 21, and 24 are rejected under 35 U.S.C. 103(a) as being obvious over Hey as applied above to claims 1, 4, 8, 19, and 17.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and

reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

With regard to claim 5, the process of Sendai comprises tilting the substrate holder during immersion such that the plating surface is positioned at an angle with respect to horizontal. As a result, contact of the plating liquid with the surface to be plated can be smoothed, and air bubbles can be prevented from remaining on the surface to be plated (col. 2, lines26-30). Knowing that it is possible to remove air bubbles underneath the substrate by tilting the substrate holder when placing it into the plating solution, it is obvious to use the same technique to prevent bubbles formation when the substrate is being removed from the solution.

With regard to claim 6, the plating bias, of the process disclosed by Hey, has a voltage level of between about 1 volts and about 10 volts (page 15, paragraph [0125]).

With regard to claim 7, the removing process of Hey further comprises rotating the substrate between about 50 rpm and about 3000 rpm to enhance removal of residual electrolyte solution from the substrate and the substrate holder assembly (page 14, paragraph [0121]).

With regard to claim 15, the substrate holder assembly, as taught by Hey, is rotated at an angular velocity of less than about 100 rpm (commonly under 30 rpm)

during the removal of the substrate from the electrolyte solution contained in the cell (page 17, paragraph [0145]).

With regard to claim 20, the removing process of Hey further comprises rotating the substrate between about 50 rpm and about 3000 rpm to enhance removal of residual electrolyte solution from the substrate and the substrate holder assembly (page 14, paragraph [0121]).

With regard to claim 21, Hey fails to disclose that the upward movement, of the substrate removal, has a duration of between about 0.5 seconds and 2 seconds. Hey, however, does teach a duration in which the substrate and the electric contacts are completely removed from the electrolyte solution within the process cell, which is relatively brief to limit the electrolyte solution drying on the face of the seed layer on the substrate or on the electric contacts. Such limiting of the electrolyte solution drying on the electric contacts also limits a crystalline coating containing copper sulfate from forming on the electric contacts that would alter the electric properties of the electric contacts (page 17, paragraph [0148]). Furthermore, an electrical bias is applied typically for a relatively brief duration of time, typically less than 30 seconds. During the time that the electrical bias is being applied: a) a first substrate is removed from the electroplating cell, b) a robot removes the first substrate from the substrate holder assembly, c) a robot inserts a second substrate into the substrate holder assembly, and d) the substrate holder system immerses the second substrate into the electroplating process cell (page 15, paragraph [0126]). Therefore, since the process to immerse and remove two substrates from an electroplating cell is performed in less than 30 seconds, the

removal of one substrate is much lesser than that period of time. Furthermore, knowing that the substrate removal must be done relatively brief, it would have been obvious to optimize the process by selecting a shorter period of time, such as 0.5 – 2 seconds in order to limit the electrolyte solution from drying on the face of the seed layer on the surface or on the electrical contacts and also to avoid the formation of any other undesired coatings that might alter the electrical properties of the electrical contacts.

With regard to claim 24, The voltage level of the removal/reverse bias of Hey, may vary as a function of the dimensions of the electrolyte cell, the composition of the electrolyte solution, the metal film, and the seed layer, etc. The substrate seed layer is typically biased anodically relative to the anode by, e.g., about a fraction of 1 volt to about 4 volts (page 15, paragraph [0126]).

6. Claims 3, 14, 22 and 23 are rejected under 35 U.S.C. 103(a) as being obvious over Hey et al. as applied, respectively, to claims 2, 8, 18 and 17 above, and further in view of Grunes (US Patent Application Publication no. 2003/0196901).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed

in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

With regard to claims 3, 14, 22 and 23, Hey teaches a constant current density and all the limitations previously mentioned in claims 2, 8, 17 and 18, respectively, but fails to teach a constant current density between about 0.5 mA/cm^2 and about 3 mA/cm^2; 0.5 to 4 mA/cm^2 or 1.5 to 3 mA/cm^2. However, Grunes discloses a method for plating metal onto wafers where the electrical current bias applies a constant current density between about 0.01 and 40 mA/cm^2 in order to achieve a good plating on the substrate surface and to prevent etching of the seed layer (page 4, paragraph [0041]). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to use a constant current density between the range as taught by Grunes, in the method disclosed by Hey, in order to obtain the desired plating surface on a substrate and to prevent etching of the seed layer.

8. Claims 10 and 19 are rejected under 35 U.S.C. 103(a) as being obvious over

Hey as applied, respectively, to claims 8 and 18 above, and further in view of Dordi et al. (6,582,578).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

With regard to claims 10 and 19, Hey teaches all of the structure as mentioned previously in claims 8 and 18, respectively, but fails to teach tilting the substrate comprising at least one of increasing or decreasing the tilt angle during the moving and wherein the angle is between about 5° and about 30°. However, Dordi discloses a method and apparatus for tilting a substrate upon entry for metal deposition in order to

minimize the chance of air bubbles getting trapped by the substrate or the substrate holder assembly. The tendency of the air bubbles to flow along the boundary layer without contacting any part of the substrate increases as the angle of tilt increases (column 34, lines 43-54). This limitation of air bubbles results from the enhanced action of the meniscus in limiting the number of air bubbles trapped as substrate is lowered into the electrolyte solution, and also lets the air bubbles escape more easily across the tilted substrate face. The electrolyte solution is drawn into the feature more quickly as the tilt angle, ranging from 0 to 90 degrees, increases (col. 35, lines 42-44).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to increase or decrease the tilt angle between 0-90 degrees as taught by Dordi, in the method of Hey, in order to minimize the chance of air bubbles getting trapped by the substrate or the substrate holder assembly since the tendency of the air bubbles to flow along the boundary layer without contacting any part of the substrate increases as the angle of tilt increases.

7. Claims 1, 2, 4, 5, 7-9, 11-13, 15-20 and 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sendai et al. (US Patent no. 7,166,204).

With regard to claim 1, Sendai discloses a plating apparatus and method comprising moving vertically a head portion/substrate holder to immerse and remove a substrate from a plating bath; applying a plating electric current between the anode and the cathode formed on the surface of the substrate when the descent of the head portion is initiated to prevent etching of the seed layer due to its contact with the plating

liquid during a period without energization. Hence, the filling properties and the uniformity of the film uniformity are improved (col. 10, lines 12-19). Knowing that it is possible to prevent etching and enhance film uniformity of a substrate as it is being placed into the plating solution by applying a plating electric bias, it is obvious to use the same technique to prevent etching when the substrate is being removed from the plating solution. Sendai also discloses a flow adjusting ring (34) which serves to push up the center of the plating liquid divided into upper and lower flows in the plating chamber (18), to smooth the lower flow, and make the distribution of the electric current density more uniform (col. 6, lines 8-13).

With regard to claim 2, the plating apparatus of Sendai discloses a flow adjusting ring that controls the electric current in order to maintain the current density more uniform (col. 6, lines 8-13).

With regard to claim 4, the method of Sendai further comprises moving vertically a head portion, holding the substrate, while imparting a rotational motion to bring its surface into contact with the plating liquid (col. 3, lines 20-23). The rotating motor and the head portion are moved up and down integrally in accordance with the driving of the elevating motor (col. 7, lines 2-4).

With regard to claim 5, the process of Sendai comprises tilting the substrate holder during immersion such that the plating surface is positioned at an angle with respect to horizontal. As a result, contact of the plating liquid with the surface to be plated can be smoothed, and air bubbles can be prevented from remaining on the surface to be plated (col. 2, lines26-30). Knowing that it is possible to remove air

bubbles underneath the substrate by tilting the substrate holder when placing it into the plating solution, it is obvious to use the same technique to prevent bubbles formation when the substrate is being removed from the solution.

With regard to claim 7, the substrate, in the method as disclosed by Sendai, is generally rotated at a rotational speed ranging from 10 to 250 rpm, preferably ranging from 40 to 200 rpm (col. 3, lines 29-31).

With regard to claim 8, Sendai discloses a plating apparatus and method comprising moving vertically a head portion/substrate holder to immerse and remove a substrate from a plating bath; a drive mechanism for rotating the head portion; a tilt mechanism for tilting the head portion so that the substrate held by the head portion is inclined relative to a horizontal plane (abstract; col. 2, lines 22-27); and applying a plating electric current between the anode and the cathode formed on the surface of the substrate when the descent of the head portion is initiated to prevent etching of the seed layer due to its contact with the plating liquid during a period without energization. Hence, the filling properties and the uniformity of the film uniformity are improved (col. 10, lines 12-19). Knowing that it is possible to prevent etching and enhance film uniformity of a substrate as it is being placed into the plating solution by applying a plating electric bias, it is obvious to use the same technique to prevent etching when the substrate is being removed from the plating solution.

With regard to claim 9, tilting the substrate, as taught by Sendai, may be maintained at a constant tilt angle in one of the embodiments (col. 8, lines 9-10).

With regard to claims 11 and 12, the plating apparatus of Sendai discloses a flow adjusting ring that controls the electric current in order to maintain the current density more uniform (col. 6, lines 8-13) across an immersed portion of the substrate.

With regard to claims 13 and 16, according to an embodiment as taught by Sendai, energization can be started based on the time when the descent of the head portion is initiated. Thus, completion of contact with the plating liquid and start of energization can be performed with close timings, thus preventing etching of the seed layer due to its contact with the plating liquid during a period without energization. Hence, the filling properties of the resulting pattern and the uniformity of the film are improved (col. 10, lines 12-19). Therefore, Sendai discloses a time dependent controller.

With regard to claim 15, the substrate, in the method as disclosed by Sendai, is generally rotated at a rotational speed ranging from 10 to 250 rpm, preferably ranging from 40 to 200 rpm (col. 3, lines 29-31).

With regard to claim 17, Sendai discloses a plating apparatus and method comprising moving vertically a head portion/substrate holder to immerse and remove a substrate from a plating bath; a drive mechanism for rotating the head portion; a tilt mechanism for tilting the head portion so that the substrate held by the head portion is inclined relative to a horizontal plane (abstract; col. 2, lines 22-27); and applying a an electric current between the anode and the cathode formed on the surface of the substrate when the descent of the head portion is initiated to prevent etching of the seed layer due to its contact with the plating liquid during a period without energization.

Hence, the filling properties and the uniformity of the film uniformity are improved (col. 10, lines 12-19). Knowing that it is possible to prevent etching and enhance film uniformity of a substrate as it is being placed into the plating solution by applying a an electric bias, it is obvious to use the same technique to prevent etching when the substrate is being removed from the plating solution.

With regard to claim 18, in the method disclosed by Sendai, the tilting, rotating and the upward movement are conducted simultaneously (col. 2, lines 24-27).

With regard to claim 19, the tilt angle, as taught by Sendai, is between 2°-10° relative to the horizontal plane (col. 2, lines 50-52).

With regard to claim 20, the substrate, in the method as disclosed by Sendai, is generally rotated at a rotational speed ranging from 10 to 250 rpm, preferably ranging from 40 to 200 rpm (col. 3, lines 29-31).

With regard to claim 25, Sendai further discloses a flow adjusting ring (34) which serves to smooth the lower flow of the plating liquid, and make the distribution of an electric current density (col. 6, lines 8-13).

With regard to claim 26, Sendai discloses an electroplating method comprising tilting a substrate to an angle with respect to the horizontal ; rotating the substrate at a rotation rate of between about 10 to 250 rpm, preferably ranging from 40 to 200 rpm (col. 3, lines 29-31 and col. 2, lines 22-27); and applying a plating/forward electric current between the anode and the cathode formed on the surface of the substrate when the descent of the head portion is initiated to prevent etching of the seed layer due to its contact with the plating liquid during a period without energization. Hence, the

filling properties and the uniformity of the film uniformity are improved (col. 10, lines 12-19). Knowing that it is possible to prevent etching and enhance film uniformity of a substrate as it is being placed into the plating solution by applying a plating electric bias, it is obvious to use the same technique to prevent etching when the substrate is being removed from the plating solution.

With regard to claim 27, a flow-adjusting ring, as taught by Sendai, adjusts the electric bias in order to make the distribution of an electric current density more uniform (col. 6, lines 8-13).

With regard to claim 28, Sendai further discloses tilting, rotating, moving and applying a forward bias conducted simultaneously (col. 8, lines 65-67 and col. 9, lines 1-5)

8. Claims 3, 6, 14, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sendai, as applied above to claims 2, 1, 8 and 17, respectively, in view of Andricacos (US Patent no. 6,974,531).

With regard to claims 3, 14, and 22-23, Sendai teaches a constant current density and all the limitations previously mentioned in claims 2, 8, and 17, respectively, but fails to teach the current density falling between about 0.5 mA/cm^2 - 3 mA/cm^2; 0.5 - 4 mA/cm^2 or 1.5 to 3 mA/cm^2. However, Andricacos discloses a method for electroplating on resistive substrates wherein the current density used for the gap fill step during plating is between 0.1 mA/cm^2 and 100 mA/cm^2 and preferably about 1mA/cm^2 -20 mA/cm^2 (col. 7, lines 59-62) in order to form a substantially continuous and uniform layer on the substrate (col. 3, lines 55-57).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to use a current density falling within the range as taught by Andricacos, in the method of Sendai in order to form a substantially continuous and uniform layer.

With regard to claims 6 and 24, Sendai discloses all the limitations discussed in claims 1 and 17, respectively, but fails to teach a voltage of 0.3V-5V. However, Andricacos teaches a method for electroplating on resistive substrates applying a voltage of about 0-20 V, more typically about 0-10 V and preferably about 0-5 V (col. 7, lines 63-65) in order to form a substantially continuous and uniform layer on the substrate (col. 3, lines 55-57).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to use a voltage falling within the range, as disclosed by Andricacos, in the method of Sendai in order to form a substantially continuous and uniform layer.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Zulmariam Mendez whose telephone number is 571-272-9805. The examiner can normally be reached on Monday-Thursday, 8:30am-5:00pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ZM 3rk

Barbara Gilliam
BARBARA GILLIAM
PRIMARY EXAMINER